



Defence Research and
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pour la défense Canada



Perspectives on retaining a DRDC Human Sciences centre...in Toronto

Ira Jacobs

Defence R&D Canada – Toronto

Technical Memorandum

DRDC Toronto TM 2006-199

August 2006

Canada

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Abstract

Defence R&D Canada (DRDC) is embarking on a central initiative to develop a comprehensive infrastructure strategy. A major objective of the initiative is to identify and justify the infrastructure required by DRDC to ensure that it remains a world leader in its Science & Technology activities. The strategy will include addressing issues such as the location of the research centres and the associated synergy that exists with industry and academia in the various research centre locations. The initial stage of this initiative involves collecting perspectives from each of the DRDC research centres. This document is a summary of the related DRDC Toronto managers' perspectives. Two main issues are addressed in the document: the importance of retention of a centralized (rather than distributed) human sciences capability by DRDC; and, considerations related to the location in Toronto.

Résumé

L'agence R & D pour la défense Canada (RDDC) se lance dans une initiative centrale visant à élaborer une stratégie d'infrastructure globale. Un objectif majeur de cette initiative consiste à déterminer et à justifier l'infrastructure requise par RDDC afin de veiller à ce que celle-ci continue d'être chef de file mondial dans ses activités de science et de technologie. La stratégie consistera entre autres à aborder des problèmes tels que l'emplacement des centres de recherches et la synergie connexe réalisée avec l'industrie et le milieu universitaire dans les divers emplacements des centres de recherches. La première étape de l'initiative portera sur la collecte de points de vue de chaque centre de recherche de RDDC. Le présent document est un résumé des points de vue des gestionnaires de RDDC Toronto. Deux questions majeures y sont abordées : l'importance qu'il y a à maintenir une capacité centralisée (plutôt que distribuée) de sciences humaines et les considérations liées à l'emplacement à Toronto.

Executive summary

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Ira Jacobs; DRDC Toronto TM 2006-199; Defence R&D Canada – Toronto; August 2006.

Defence R&D Canada (DRDC) is embarking on a central initiative to develop a comprehensive infrastructure strategy. A major objective of the initiative is to identify and justify the infrastructure required by DRDC to ensure that it remains a world leader in its Science & Technology activities. The strategy will include addressing issues such as the location of the research centres and the associated synergy that exists with industry and academia in the various research centre locations. The initial stage of this initiative involves collecting perspectives from each of the DRDC research centres. This document is a summary of the related DRDC Toronto managers' perspectives.

Defence R&D Canada – Toronto (DRDC Toronto) is Canada's centre of excellence for human effectiveness science and technology in the defence and national security environment. Using a systems-based approach, the centre covers all aspects of human performance and effectiveness: individual and team performance, human-machine interaction, and the influence of culture on operational readiness. DRDC Toronto also supports the operational needs of the Canadian Forces (CF) through research, advice, test and evaluation, and training in the undersea and aerospace environments.

Two main issues are addressed in the document: the importance of retention of a centralized (rather than distributed) human sciences capability by DRDC; and, considerations related to the location in Toronto. DRDC Toronto's managers recommended that DRDC should retain a centre dedicated to human sciences. The rationale for retention of such a centre in Toronto hinges primarily on the following:

- importance for S&T challenges of a DRDC presence in Canada's largest and most heterogeneous setting;
- the relationship with the Canadian Forces Environmental Medicine Establishment which is a military unit co-located with DRDC Toronto; the consequences and costs for the CF, DND, and DRDC of a dissolution of that relationship.
- the costs of either relocation or loss of human sciences expertise and facilities.

Sommaire

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Ira Jacobs; DRDC Toronto TM 2006-199; R & D pour la défense Canada – Toronto; August 2006.

L'agence R & D pour la défense Canada (RDDC) se lance dans une initiative centrale visant à élaborer une stratégie d'infrastructure globale. Un objectif majeur de cette initiative consiste à déterminer et à justifier l'infrastructure requise par RDDC afin de veiller à ce que celle-ci continue d'être chef de file mondial dans ses activités de science et de technologie. La stratégie consistera entre autres à aborder des problèmes tels que l'emplacement des centres de recherches et la synergie connexe réalisée avec l'industrie et le milieu universitaire dans les divers emplacements des centres de recherches. La première étape de l'initiative portera sur la collecte de points de vue de chaque centre de recherche de RDDC. Le présent document est un résumé des points de vue des gestionnaires de RDDC Toronto.

R & D pour la défense Canada – Toronto (RDDC Toronto) est le centre canadien par excellence en matière de science et de technologie liées à l'efficacité humaine dans le milieu de défense et de sécurité nationale. Grâce à une méthode basée sur les systèmes, le centre couvre tous les aspects de la performance et de l'efficacité humaines : performance individuelle et performance de l'équipe, interaction homme-machine et l'influence de la culture sur l'état de préparation opérationnelle. RDDC Toronto soutient également les besoins opérationnels des Forces canadiennes (FC) par la recherche, les conseils, l'essai et l'évaluation et des instructions dans des environnements sous-marins et aérospatiaux.

Deux questions majeures sont abordées dans le document : l'importance qu'il y a à maintenir une capacité centralisée (plutôt que distribuée) de sciences humaines et les considérations liées à l'emplacement à Toronto. Les gestionnaires de RDDC Toronto ont recommandé le maintien par RDDC d'un centre spécialisé dans les sciences humaines. Les raisons avancées concernent principalement :

- l'importance des défis S & T que comporte une présence de RDDC dans le plus grand et le plus hétérogène des secteurs du Canada
- les relations avec le Centre de médecine environnementale des Forces canadiennes, qui est une unité militaire coimplantée avec RDDC Toronto; les conséquences et les coûts que la dissolution de ces relations feront subir aux FC, au MDN et à RDDC.
- les coûts soit d'une réinstallation ou de la perte d'expertise et d'installations relatives aux sciences humaines

Table of contents

Abstract	i
Résumé	ii
Executive summary	iii
Sommaire.....	iv
Table of contents	v
Background	1
Experimentation with humans	1
Effectiveness & efficiencies	2
Current status.....	2
Investment strategies	2
Canadian Forces Environmental Medicine Establishment	3
Toronto location	3
Conclusions	4

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Background

Defence R&D Canada – Toronto (DRDC Toronto) is Canada's centre of excellence for human effectiveness science and technology in the defence and national security environment. Using a systems-based approach, the centre covers all aspects of human performance and effectiveness: individual and team performance, human-machine interaction, and the influence of culture on operational readiness. DRDC Toronto also supports the operational needs of the Canadian Forces (CF) through research, advice, test and evaluation, and training in the undersea and aerospace environments.

In 1939, the Department of National Defence (DND) established its first centre to specialize in human sciences, specifically, human experimentation for military needs (the centre would go through several different identities, eventually settling on its current name: DRDC Toronto). As a result of DND's continuing investment since that time, DRDC now possesses a world-leading human sciences capacity which is respected in allied defence science circles for the excellence of its multidisciplinary and integrative capabilities. Three factors that reinforce the criticality of DRDC maintaining and nurturing a dedicated human sciences centre of expertise are:

- evolving knowledge about human complexity;
- the interaction with technological advances to take advantage of that complexity: and,
- the changing nature of the threats facing the CF.

These continuing investments in its human sciences centre have allowed the Agency to be well positioned to exploit the evolving understanding of how human complexity can be effectively leveraged when integrating the “human system” with other complex systems. Such understanding is also critical for understanding our potential vulnerabilities as well as those of adversaries.

Experimentation with humans

As the only multidisciplinary human sciences research centre operated by any level of government in Canada, DRDC Toronto now has over 60 years of experience with human experimentation. This enables DRDC to engage in effective, efficient, and ethical experimentation, and to do so in a fashion that is compliant with rigorous domestic and international standards, guidelines, and legislation. This is particularly important given the research ethics complexities, and associated sensitivities, posed by several of the DND S&T Strategy challenges; this will require human research in areas such as understanding and mitigating malicious intent of adversaries. Society's experts are currently struggling with the research ethics associated with advances in domains such as genomics and the convergence with nanotechnology and information technology. DRDC will benefit by continuing to nurture its in-house research ethics capacity, including comptrollership, in order to exploit the related advances for defence and security S&T, and avoid historical mistakes attributable to government research programs before the advent of the regulatory policies and guidelines that currently guide us.

Effectiveness & efficiencies

Having a dedicated human sciences centre has proven to be an attractive feature for recruitment of high quality personnel, for their professional development, and for their retention. If DRDC did not have such a centre, the distribution of its human sciences expertise across other research centres would likely compromise the retention of scientific excellence in human sciences and/or require costs more than \$100M to re-distribute current expertise elsewhere. Some other important related consequences include the following:

- less “face validity” with allied defence S&T organizations all of which have one or more human sciences centres;
- loss of resource management economies of scale gained by locating all of the experimentation test facilities and other resources required to support human experimentation in one centre;
- difficulties for clients/stakeholders to readily identify where work requiring human experimentation can/should be executed; and,
- more challenges to ensure that DRDC experimentation is conducted in a fashion that is fully compliant with ethical guidelines, policies, and laws.

Current status

DRDC Toronto is located on approximately 5.7 hectares (14 acres) of prime land in Toronto. DRDC is the responsible and accountable managing organization for this property. If required, this space could easily accommodate expansion. The infrastructure real asset value, including the buildings and the major experimental facilities/chambers, is estimated to be more than \$200M. The experimental facilities constitute significant infrastructure components that would be difficult, if not impossible to move, and extremely expensive to reconstruct. They include: a human centrifuge to simulate acceleration forces to which combat pilots are exposed; thermal chambers to induce cold and heat stress under controlled conditions; a hypobaric chamber to simulate altitudes up to 100,000 feet; hyperbaric chambers to simulate depths of up to 5,300 ft of sea water; and, a high impact facility to simulate the effects of acceleration forces involved in vehicle crashes.

Investment strategies

DRDC Toronto is currently DRDC’s smallest centre and, because of the nature of its research activities (human sciences as compared to engineering), it is relatively inexpensive to operate. Currently, major infrastructure upgrades are being completed at a cost of about \$23M, the first major infrastructure upgrade since the centre opened at its current site more than 30 years ago. It is estimated that the infrastructure upgrades should suffice for more than 20 years. In order to

propel DRDC's human sciences capacities to the class of "world leader" in the implementation of the DND S&T Strategy, infrastructure investments in experimental facilities in the order of \$25M will be required. This would support the initiation of integrated high impact programs in the domains of human-systems integration and the behavioural, cognitive, and sociological sciences.

Canadian Forces Environmental Medicine Establishment

DRDC Toronto has the largest military component of any DRDC centre because of the co-location of the CF Environmental Medicine Establishment (CFEME), a Director General Health Services (DGHS) military unit with a CF operational support role in Force Generation. The unit is co-located within the walls of DRDC Toronto in accordance with the terms of a Mutual Support Arrangement between Chief Military Personnel and ADM(S&T). The 60 CFEME military members execute their CF operational role while being embedded within DRDC, augmenting our staff strength by 25-35% in scientific, logistic, administrative, and other support roles. Their contributions are critical to maintaining DRDC knowledge generation and applications to performance and health challenges of military operations in harsh and specialized environments. The specialized training and experiences of the following classifications exemplify those resident within CFEME: biosciences officers, life support and safety systems technicians, pilots and aerospace engineers, divers, preventive medicine technicians, industrial hygienists, nurses, and physicians. The CF Aerospace and Undersea Medical Science Centre at DRDC Toronto is staffed primarily by CFEME uniformed personnel. All physicians at DRDC Toronto are CFEME personnel; many human experimentation protocols are approved conditional on the presence of a physician with expertise and training that is typically only acquired by military medical officers. This large military component of DRDC Toronto facilitates much broader interaction with the CF and operationalization of S&T outputs. The CO/CFEME has indicated that it is highly unlikely that CFEME would follow if DRDC's human sciences centre was moved elsewhere, thus the consequence for DRDC would be the loss of key, if not critical, capabilities. The effects of a DRDC Toronto/CFEME dissociation would also have consequences for the CF because of the magnitude of the costs associated with moving the unit and the disruptions to CFEME's support to Commander Operational Support Command, Chief Military Personnel, Chief Maritime Staff, and Chief Air Staff.

Toronto location

Maintaining a DRDC presence in Toronto is well aligned with the recent trend of the CF to augment their presence in large urban centres. Toronto is Canada's most populated city and, in terms of culture, race, ethnicity and immigration, arguably the most heterogeneous city in the world. There are also those who claim that Toronto reflects the future face of Canada. These same characteristics pose both defence and national security/public safety challenges for those national, provincial, regional and municipal organizations tasked with related responsibilities, precisely because of Toronto's character. As DRDC initiates its S&T mandate in support of such

organizations, careful consideration should be given to the potential advantages gained by a presence of DRDC's human sciences centre in an ideal location for models of human diversity.

Other factors of relevance to the Toronto location are listed below.

- Other than DRDC Suffield, Toronto is the sole DRDC presence west of Ottawa;
- There are at least nine universities within a 250 km radius of Toronto from which Toronto has recruited staff, and with which there is an active history of contracting. Many of our scientists have adjunct faculty appointments which augment and stimulate the centre's program.
- The DRDC Toronto innovation hub, i.e. the *Human Sciences Hub*®, has partnering agreements with local industry and organizations (e.g. Atlantis Systems International, MaRS Discovery District).
- Our proximity to the CF Land Force Central Area Headquarters, Joint Task Force Command and the Canadian Forces College in Toronto, and participation as educators at the latter, are outlets for strategic level exploitation of DRDC human sciences outputs.
- Toronto poses challenges for personnel unlike those faced in other municipalities because of the cost of living which is so much higher than at our other centres (without any offsetting allowances) and the stresses of commuting.

It is the consensus of DRDC Toronto management that none of these factors alone or together should be viewed as sufficiently important to preclude location of a DRDC human sciences centre elsewhere.

Conclusions

DRDC Toronto's managers are unanimous in their view that DRDC should retain a centre dedicated to human sciences. The rationale for retention of such a centre in Toronto hinges primarily on the following:

- importance for S&T challenges of a DRDC presence in Canada's largest and most heterogeneous setting;
- the relationship with CFEME; the consequences and costs for the CF, DND, and DRDC of a dissolution of that relationship.
- the cost of either relocation or loss of human sciences expertise and facilities.

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